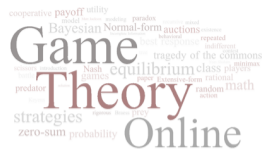# Example: Mixed Strategy Nash

Game Theory Course:
Jackson, Leyton-Brown & Shoham

Example - Soccer Penalty Kicks

- Mixed strategies in sports and competitive games
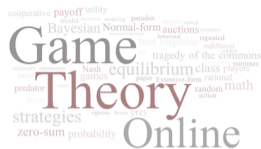
Example - Soccer Penalty Kicks

- Mixed strategies in sports and competitive games

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Example - Soccer Penalty Kicks

- Mixed strategies in sports and competitive games

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- How do equilibrium strategies adjust to skills?

- Should a kicker who kicks penalty kicks worse to the right than left kick more often to the left than right?

$Kicker/Goalie$	$Left$	$Right$
$Left$	$0,1$	$1,0$
$Right$	$1,0$	$0,1$

$Kicker/Goalie$	$Left$	$Right$
$Left$	$0, 1$	$1, 0$
$Right$	$.75, .25$	$0, 1$

Example - Soccer Penalty Kicks

- In a mixed equilibrium, the goalie's strategy must have the kicker indifferent

Example: Mixed Strategy Nash

Example - Soccer Penalty Kicks

- In a mixed equilibrium, the goalie's strategy must have the kicker indifferent

- p probability goalie goes left; Kicker indifferent: $(1-p)1 = p.75$
  or $p = 1/1.75 = 4/7$

Example - Soccer Penalty Kicks

Game Theory Online

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- Goalie goes Left more often than Right (4/7 to 3/7), kicker still goes Left and Right with equal probability
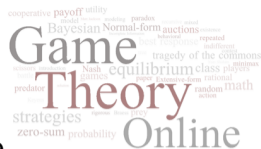
Example - Soccer Penalty Kicks

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- Goalie's strategy adjusts, and the kicker actually adjusts to kick more to their weak side!

- The Goalie has a slight advantage now, and wins $4/7$ of the time

Example - Soccer Penalty Kicks

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- If the goalie still played equal probability, then the kicker could always go left and win 1/2 the time instead of 3/7

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- By adjusting the strategy to keep the kicker indifferent, the Goalie takes advantage of the kicker's weak right kick and wins more often!

- A players must be indifferent between the actions he or she randomizes over

- Interesting comparative statics

- Do players really do this?!